

REMARKS

Claim 12 has been amended to overcome the objection to that claim set forth on page 2 of the Action. This amendment is fully supported by the specification and claims as originally filed. Thus, no new matter is added herein.

Rejection under 35 USC §103

Claims 1-29 stand rejected under 35 U.S.C. 103(a) as being unpatentable in view of U.S. Patent No. 5,026,927 (Andrews et al.). Applicants respectfully disagree. The claimed process demonstrates a surprising increased yield and increased selectivity towards glycols. The prior art as a whole, which includes the Andrews et al. reference and U.S. Patent No. 3,935,284, does not suggest these surprising results and therefore does not render the claimed invention obvious.

The Prior Art

The Examiner correctly notes that the Andrews et al. reference teaches a process for the hydrogenolysis of a sugar feedstock in a solvent in the presence of a ruthenium/phosphine catalyst and an optional base promoter. The Examiner also correctly notes that Andrews et al. generally teaches that the solvent can be water and that the hydrogenolysis can be conducted at from 25°C to 200°C (see Col. 3, lines 15-17 and lines 34-40). It is noted that Andrews et al. prefers a hydrogenolysis temperature of between 50°C and 150°C (claim 10). Andrews et al. does not exemplify a hydrogenolysis process of the type claimed, i.e., one which is carried out at a temperature greater than 150°C in the presence of water.

Applicants have submitted with this paper a copy of U.S. Patent No. 3,935,284 (Kruse et al.). This patent pertains to the hydrogenation of saccharides using a ruthenium triphenyl phosphine complex and discloses that, in general, at temperatures above 150°C, a ruthenium triphenyl phosphine catalyst decarbonylates the substrate (column 5, lines 19-29) leading to a carbonyl complex of the ruthenium triphenyl phosphine. Kruse et al. state that these carbonyl complexes are not efficient catalysts for the hydrogenation.

The Examiner nevertheless concludes that "it would have been *prima facie* obvious to one having ordinary skill in the art to arrive at the presently claimed invention."

The claimed invention demonstrates unexpected results

In short, the claimed process differs from that of Andrews et al. in that in the former the presence of water is required and a higher temperature is used. These differences are important because they produce unexpected results. The examples in Andrews et al. show that at 100°C and 20.7 bar (300 psi) hexitols are the main product and a substantial amount of glycerol and very little ethylene glycol and propylene glycol are formed. Example 59 of the subject application shows that when the hydrogenolysis is carried out at 150°C (i.e., just below the claimed temperature range) and 69 bar (1000 psig) the conversion is low but there is some selectivity towards ethylene glycol and propylene glycol. Tables 1 and 13 show that at 190°C, 200°C and 225°C, the hydrogenolysis conversion is much greater but a large amount of glycerol is still being formed and that only at 250°C is this substantially reduced. However, the selectivity of the reaction towards glycols in the claimed temperature range (greater than 150°C) is always better than at the lower temperatures exemplified in Andrews et al. This improvement in selectivity is certainly unexpected in view of Andrews et al.

Further, it is known from Kruse et al. that a ruthenium triphenyl phosphine catalyst decarbonylates its substrate at temperatures much above 150°C, rendering the catalyst inefficient. In the light of this teaching, the person of ordinary skill in the art would not have expected any improvement in the yield or selectivity of the process when carried out above 150°C, even in the presence of water.

The claimed invention therefore unexpectedly provides an improved process for the hydrogenolysis of a sugar feedstock. This result is surprisingly achieved by carrying out the hydrogenolysis process in the presence of water and at a temperature above 150°C. The Andrews et al. and Kruse et al. references do not remotely suggest the improvement in the hydrogenolysis process achieved by the claimed invention. As a result, the invention as claimed is clearly not obvious in view of the pertinent prior art.

Conclusion

There is nothing in Andrews et al. or Kruse et al, alone or in combination, or anywhere else in the prior art, to suggest that conducting the hydrogenolysis in the presence of water and at a temperature above 150°C would lead to the increased

yield and increased selectivity towards glycols that is shown in the subject application. Applicants respectfully request the Examiner to reconsider and withdraw the 35 U.S.C. § 103(a) rejection.

In view of the above amendments and remarks, Applicants respectfully submit that the claims are in condition for allowance. A Notice of Allowance is therefore respectfully solicited.

The Applicants urge the Examiner to contact the Applicants' undersigned representative at (312) 913-2136 if he believes that a discussion would expedite prosecution of this application.

Respectfully submitted,

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By: /Steven J. Sarussi/
Steven J. Sarussi
Reg. No. 32,784

McDonnell Boehnen
Hulbert & Berghoff LLP
300 South Wacker Drive
Chicago, Illinois 60606
(312) 913-0001